

Clinical outcomes of thoracic trauma in pediatric patients: An examination of admissions to the department of thoracic surgery

Clinical outcomes of thoracic trauma in pediatric patients

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Abstract

Aim: The aim of this study is to examine the demographic characteristics, trauma etiologies, diagnosed pathologies, and treatment methods of pediatric patients aged 10-17 who were admitted to the thoracic surgery department with isolated thoracic trauma.

Material and Methods: This retrospective study encompasses 46 pediatric patients diagnosed with isolated thoracic trauma during the specified period. Demographic information, trauma etiologies, diagnosed pathologies, and treatment methods were collected from the hospital information system. Descriptive statistics were applied for the analysis of data.

Results: The study found that the majority of patients were male (87%) with an average age of 15.5. The leading causes of trauma were penetrating-cutting instrument injuries (39.1%), traffic accidents (26.0%), and bicycle falls (10.9%). The most commonly encountered pathologies were pneumothorax (47.8%) and lung contusion (19.6%). While most patients were adequately treated with medical therapy, 36.9% required tube thoracostomy and 10.9% underwent surgical intervention.

Discussion: The findings reveal the etiological diversity and the wide range of treatment methods in pediatric isolated thoracic traumas. The study underscores the importance of a multidisciplinary approach in the management of pediatric thoracic traumas, indicating that isolated thoracic traumas generally have a good prognosis. However, the frequency of penetrating traumas and the necessity for surgical intervention require careful evaluation and approach in clinical practices.

Keywords

Pediatrics, Pneumothorax, Thoracic Trauma

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Introduction

Thoracic trauma ranks among the significant traumatic injuries encountered in childhood, posing a major cause of morbidity and mortality [1]. In children, thoracic trauma commonly results from high-energy impacts, falls, and crush injuries, potentially affecting the respiratory system, cardiovascular system, and other vital organs, thus necessitating rapid and effective intervention. The anatomical and physiological characteristics of the thorax in the pediatric population differentiate the effects of trauma from adults; for instance, the more flexible chest walls and faster respiratory rates in children can increase the risk of post-trauma complications [2]. These differences necessitate age-specific diagnostic and treatment approaches. Epidemiological data suggest that pediatric thoracic trauma cases constitute less than 10% of all pediatric trauma cases [3]. The most common types of thoracic trauma include contusions, rib fractures, pneumothorax, and hemothorax [4]. The management of these injuries varies depending on the child's age, the severity of the trauma, and the presence of accompanying injuries. Timely and effective management of pediatric thoracic trauma cases is crucial for determining the short and long-term health outcomes of the patient.

The aim of this study is to examine the demographic characteristics, causes of trauma, clinical findings, treatment methods, and clinical outcomes of pediatric patients who presented to the emergency department with thoracic trauma and were subsequently admitted to the thoracic surgery department.

Material and Methods

This study was carried out in the thoracic surgery clinic of a tertiary hospital. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

This study encompasses patients who were admitted to the thoracic surgery department due to isolated thoracic trauma between 2012 and 2022. The data included in the study were collected using a retrospective scanning method through the hospital information management system. Detailed records were kept of the patients' demographic characteristics, the type of trauma, accompanying pathologies, applied surgical and medical treatments, lengths of hospital stay, and mortality rates. Patients with other systemic traumas or those who could not be fully documented medically during the study period were excluded.

All pediatric patients presenting to the emergency department with complaints of thoracic trauma were jointly evaluated at the initial assessment stage by a pediatric surgery specialist and a pediatric emergency medicine physician. Expert opinions from relevant medical disciplines were obtained for the identification and management of accompanying pathologies. Depending on their conditions and clinical needs, diagnostic tests such as thoracic radiography and electrocardiogram were administered to patients. The primary pathological findings necessitating treatment were accepted as the primary diagnosis.

Patients with injuries that could be treated with simple medical interventions were observed for a few hours based on the severity of their condition. Depending on the severity of the

injury, those requiring further treatment were admitted to the ward or intensive care units.

Statistical analysis

The statistical analysis of the dataset was performed using SPSS software for Windows (Version 29, Chicago, IL, USA). The analysis process of the study was conducted based on patients' demographic characteristics, trauma etiologies, diagnosed pathologies, and applied treatment methods. Initially, descriptive statistics were used to summarize patients' demographic information such as age and gender, along with trauma etiologies and treatment outcomes. For this purpose, mean and standard deviation values were utilized for quantitative data, while percentages were employed to determine the distribution of categorical data. In the analysis, frequency distributions and tables were created to visualize the distribution of trauma etiologies and treatment methods.

Ethical Approval

This study was approved by the Ethics Committee of Kartal Dr. Lütfi Kırdar City Hospital (Date: 2023-04-27, No: 2023/514/248/15).

Results

Of the 46 patients included in the study, 40 were male, and 6 were female, with an average age of 15.5. According to the etiology of the trauma, penetrating-cutting instrument injuries (39.1%) were the most common, followed by traffic accidents (26.0%) and bicycle falls (10.9%). When etiological factors were classified as blunt and penetrating trauma, blunt thoracic traumas were observed at a rate of 47.8%, while penetrating traumas were observed at 52.2%. The etiological causes are summarized in Table 1. At the time of diagnosis, pneumothorax (47.8%) and lung contusion (19.6%) were the two most frequently observed pathologies. Hemothorax, sternum and rib fractures, superficial injuries to the chest wall, and pneumomediastinum were other encountered pathological conditions. Forty (87%) of the patients included in the study were male. Pathologies were observed on the left side in 52.2% of cases.

52.2% of the patients were healed with medical treatment, tube thoracostomy was applied to 17 patients (36.9%), and 5 patients (10.9%) underwent surgery. The surgeries included foreign body removal, rib stabilization, bleeding control, and wedge resection (Table 2).

The average hospital stay was 4 days, and it was found necessary for one patient to be admitted to the intensive care unit. No mortality cases were reported during the study (Table 3).

Table 1. Etiologies causing trauma

Trauma types	Number	Percentage
Stabbing injury	18	39.1%
Traffic accident	12	26.0%
Bicycle accident	5	10.9%
Fall	4	8.7%
Gunshot wound	3	6.5%
Sports accident	2	4.3%
Needle sticking in the back	1	2.2%
Plane crash	1	2.2%

Table 2. Distribution of patients according to treatment types

	N	%	
Intervention	Medical	24	52.2
	Tube thoracostomy	17	36.9
	Surgery	3	6.5
	Tube thoracostomy + surgery	2	4.4
Operation	Foreign body removal	2	4.3
	Bleeding control	1	2.2
	Stabilization	1	2.2
	Wedge resection	1	2.2
-	41	89.1	
Complication	Absent	46	100
	Present	0	0

Table 3. Patients' ward admission durations, intensive care unit admission rates, and mortality statuses

Ward admission	2-9 day (min-max)	4.00 day (median)	4.48 ± 1.86 (Mean±sd/n-%)
Intensive care unit admission	Absent	45	97.8%
	Present	1	2.2%
Mortality	Present	0	0,00%

Discussion

In this study, pediatric patients admitted to the thoracic surgery department due to isolated thoracic trauma were examined. According to the results of the study, the most common causes of trauma were penetrating-cutting instrument injuries, traffic accidents, and bicycle falls, and pneumothorax and lung contusion were among the most common diagnoses. While most patients recovered with medical treatment, some required tube thoracostomy or surgical intervention.

Childhood injuries differ from adult injuries in terms of anatomical differences and the manner in which the injury occurs [5, 6]. Trauma-related deaths rank first among causes of death in children in developed countries. Thoracic traumas are the second leading cause of trauma-related child deaths [7]. The literature reports that 90% of children's injuries are in the form of blunt trauma, with penetrating injuries seen with increasing frequency. It has been observed that male children are more exposed to trauma [8, 9]. However, in our study, although blunt and penetrating traumas were seen at almost similar rates (%47.8 vs. %52.2), the most common cause was penetrating traumas. Consistent with the literature, our study found that male children were more likely to present with trauma.

In our country, a study conducted in 2012 on children presenting to the emergency department with chest trauma found that motor vehicle accidents and falls were the leading causes of trauma etiology, with an average age of 10 [5]. Another study in 2020 reported that traffic accidents were the most common etiological reason for children visiting the emergency department due to trauma, with an average age of 8.9 [10]. Similarly, a 2016 study identified falls from height as the most frequent etiological cause of childhood traumas, recording an average age of 7.92±5.11 [11]. In our study, the most frequent

etiological cause was injuries from penetrating-cutting instruments, with an average age of 15.5. We believe the differences in these studies regarding the average age and the etiological causes might be attributed to geographical variations and seasonal factors. Lung contusion and pneumothorax are the most commonly observed pathologies in thoracic traumas [3]. Pneumothorax was reported in 37% of children experiencing thoracic trauma as isolated pneumothorax and in 11% in conjunction with hemothorax [12]. Hemothorax in childhood is a rare complication of rib fractures, most commonly due to the sharp edges of intrathoracic fractures cutting the diaphragm or pleura [13-15]. In our study, pneumothorax was the most common pathological condition, followed by lung contusion and hemothorax.

In a study on 60 patients with traumatic pneumothorax in children, 34 patients (56.7%) were treated conservatively, while a chest tube was placed in 24 patients (40.0%), thoracotomy was performed on two patients (3.3%), and thoracoscopy on one patient (1.7%) [16]. The most commonly performed surgical intervention in thoracic traumas is tube thoracostomy [5]. In our study, 24 patients (52.2%) were followed up with medical treatment, tube thoracostomy was applied to 17 patients (36.9%), and surgery was performed on 5 patients (10.9%).

Thoracic organ injuries in children are less common than in adults but carry a higher mortality rate [17]. While the mortality rates for isolated chest traumas vary between 4-12%, this rate increases in the presence of accompanying organ injuries [18]. In our study, no complications or mortality were observed.

Limitations

The limitations of this study include potential data deficiencies and recording errors due to its retrospective design. Additionally, generalizing data obtained from a single center may not accurately reflect pediatric thoracic trauma cases in different geographical and socio-economic regions. The limited number of patients in the study makes it difficult to draw definitive conclusions about large-scale epidemiological trends. Lastly, focusing on isolated thoracic trauma cases limits the opportunity to evaluate the effects and management of multiple traumas.

Conclusion

This study examined the etiology, clinical characteristics, and treatment outcomes of isolated thoracic trauma in pediatric patients. According to the results, injuries from penetrating-cutting instruments, traffic accidents, and bicycle falls were identified as the most common causes of trauma. The nearly equal distribution of blunt and penetrating traumas underscores the diversity and complexity in managing pediatric thoracic traumas. Pneumothorax and lung contusion were determined as the most frequently diagnosed pathologies, with most patients successfully recovering with medical treatment. However, the presence of cases requiring tube thoracostomy and surgical intervention highlights the necessity for more aggressive treatment approaches in certain situations.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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